Using Repellents for Reducing Deer Damage to Christmas Trees

Figure 1. *Deer feeding in a fir tree planting at the Sweeting Farm on 20 March 2021.*

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Introduction

Damage to ornamental flowers, shrubs, field crops, orchards, and tree farms by white-tailed deer is substantial throughout many parts of North America (Drake et al. 2005, Curtis 2020). Nationwide, the economic impacts attributed to deer have been estimated at $100 million and $251 million annually for the agriculture and urban sectors, respectively (Conover 1997). In southeastern New York, nursery producers with deer damage spent an average of $20,000 annually to prevent browsing (Sayre and Decker 1990). White-tailed deer are locally overabundant at many locations in the Great Lakes region and cause economic losses on Christmas tree farms.

Christmas tree growers need reliable repellents to protect their trees from deer browsing damage, especially during winter when deer feed mostly on woody browse. In past research, the efficacy of commercial deer repellents was highly variable, and existing products did not provide reliable protection from deer browsing beyond 4 to 6 weeks during times when deer feeding pressure was high (Curtis and Boulanger 2010). Although several deer repellents are currently on the market, Deer-Away Big Game Repellent, made from putrescent egg solids, appeared to be the most promising formulation in several field tests, reducing deer browsing by an average of 50% (El Hani and Conover 1995, Wagner and Nolte 2001, Curtis and Boulanger 2010). However, for many tree growers, this still is an unacceptable level of protection.

Further research is needed to develop and test novel, long-lasting deer repellents. Therefore, we evaluated a new deer repellent (Trico®) formulated from "sheep fat" (6.4% active ingredient) that was developed in Europe to protect trees from deer browsing. Palmer (2017) reported an "excellent performance history" for Trico® deer repellent in northern Europe. Trico® was registered in 2021 as a deer repellent (Environmental Protection Agency Reg. No. 71637-2) in 14 states (CO, GA, KS, ME, MN, NJ, NY, OK, OR, PA, TN, TX, VT, and WA). Currently the manufacturer is in the process of seeking registration for Trico® in additional states.

Food selection by herbivores is complex. In theory, repellents work by reducing the palatability of treated plants relative to other available forage (El Hani and Conover 1995). Past research (Sayre and Decker1990) has shown that Fraser and balsam firs are the Christmas tree

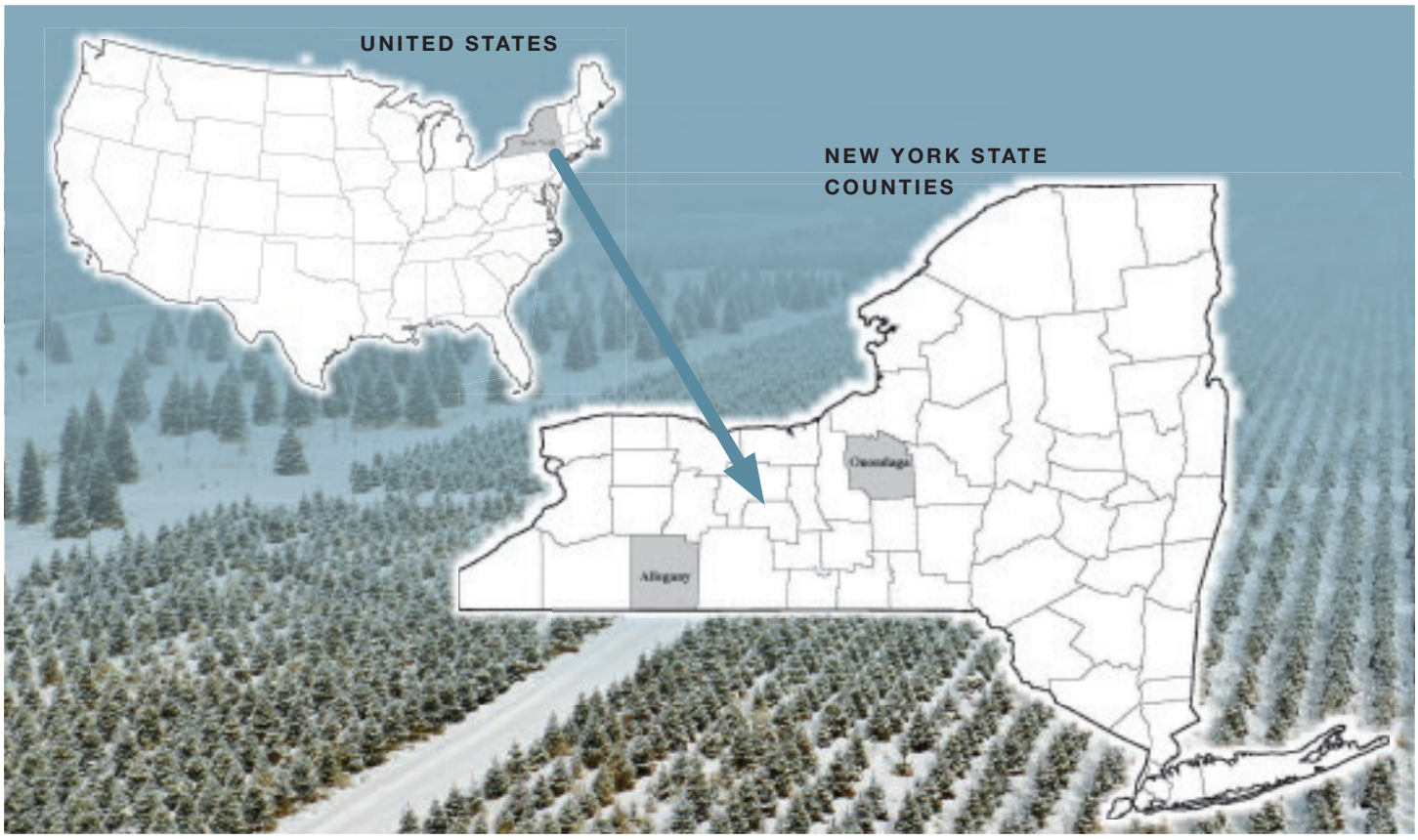

Figure 2. *The study farm that did not experience damage in the winter of 2019-20 was located in Onondaga County, and the two farms that experienced deer damage were both located in Allegany County, New York, USA.*

varieties most susceptible to deer feeding damage (Figure 1). Therefore, we tested Trico® deer repellent on commercial Christmas tree farms with a history of deer damage that were growing these varieties. To better understand the longevity of this new repellent, our objective was to compare the relative efficacy of Trico® to Plantskydd®, a commonly used deer repellent that contains the natural ingredient "dried blood" (84.5% a.i.).

All study farms had young fir trees approximately 3-6 feet in height and accessible to deer feeding. Prior deer damage to trees was observed on these farms during field scouting. In winter 2019-20, we tested repellents on the Wiles Farm located just south of Syracuse, NY, and the Fetzer Farm near Bolivar, NY. In winter 2020-21, we again tested the repellents on the Fetzer Farm, and added the Sweeting Farm near Wellsville in Allegany County, NY (Figure 2) because the trees on the Wiles Farm experienced no deer damage the prior winter.

During late October 2019, we tagged 20 trees in each of three groups (Trico®, Plantskydd®, and controls). This required 60 fir trees of the appropriate age on each of the two farms, for a total of 120 trees in the experiment. Each study tree was tagged with numbered, colored flagging, with a different tag color for each treatment. Trees were sprayed with a backpack sprayer following label instructions during late October/November 2019. In winter 2020-21, we included 30 trees for each treatment for a total of 90 study trees per farm, or 180 trees in the experiment.

The Trico® repellent was applied undiluted, and all growing points of each tree were sprayed. The amount per tree varied depending upon the size of the tree. Baseline photographs were taken of all trees with a digital camera on the first day of trial at each farm. Deer damage was evaluated at the end of the trial on 31 March at the Wiles Farm, and on 14 April 2020 at the Fetzer Farm. We used a white board as a background for reference photographs and each plant was labeled (Figure 3). We also noted any evidence of recent deer tracks and droppings near the plots. Trail cameras were installed to document deer presence and behavior on the study farms (Figure 1). During both winters, counts of deer-browsed limbs were made on each fir tree damaged during the study, and photographs were taken to document the surface area removed from each tree.

Figure 3. *Untreated control fir tree C23 on the Sweeting Farm near Wellsville, NY, at the beginning of the trial on 6 November 2020, and the same tree at the end of the winter on 14 April 2021. Note change in form and several missing branch tips. This sample photograph was typical of all trees in the control treatment.*

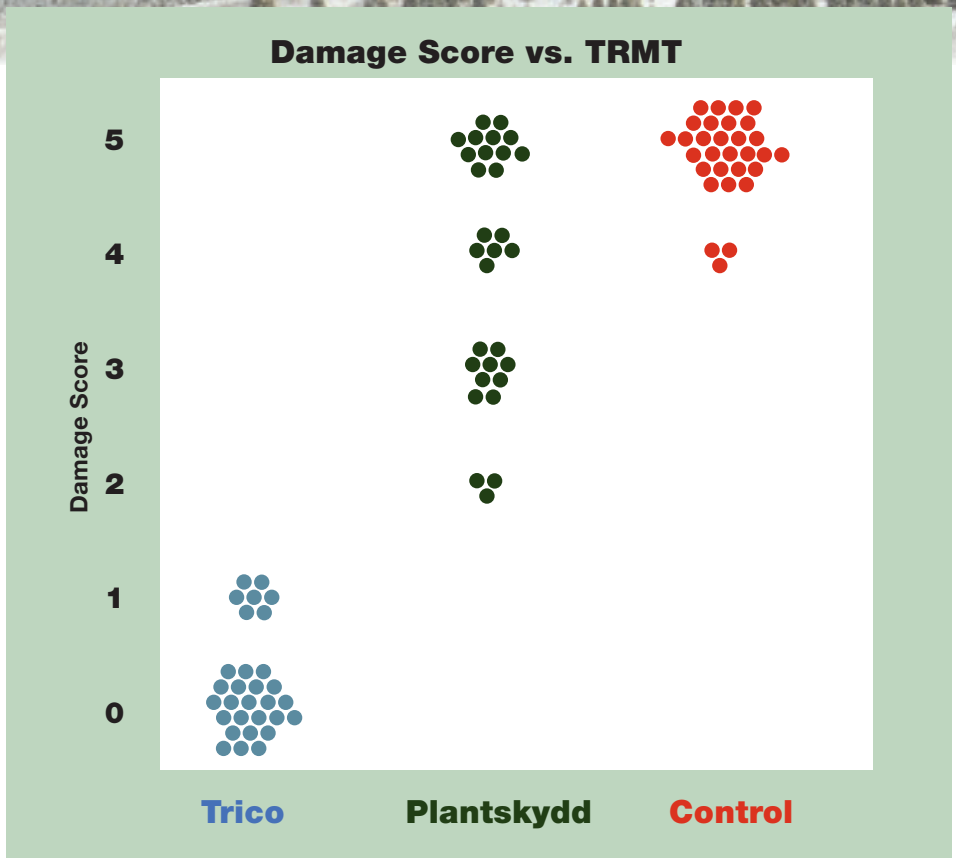

Figure 4. *Damage scores for white-tailed deer browsing on fir trees by treatment during winter 2020-21 at the Sweeting Farm near Wellsville, New York. Black dots are scores for individual trees, and damage scores were 0= no damage, 1= 1-20% limbs browsed, 2= 21-40% limbs browsed, 3= 41-60% limbs browsed, 4= 61-80% limbs browsed, and 5= >80% limbs browsed.*

In winter 2020-21, we again counted limbs browsed by deer on each study tree, and we also scored deer damage with a visual rating system based on the total % of limbs browsed on each tree (0= no damage, 1= 1-20% of limbs browsed, 2= 21-40% of limbs browsed, 3= 41-60% of limbs browsed, 4= 61-80% of limbs browsed, and 5= >80% of limbs browsed). We looked at the outer surface of the tree and estimated the percentage of stem tips damaged by deer.

Results

There was no deer damage observed on fir trees at the Wiles Farm during winter 2019-20, however we observed significant deer damage to fir trees at the Fetzer Farm. Weather and other factors experienced during this winter were very unusual at the Wiles Farm in Onondaga County. First, there was an abundant natural mast crop in fall 2019, so there were plenty of red oak acorns and apples available for deer to feed on, well into the winter months. Deer were frequently observed in and around the Christmas tree plantings, but they were not forced to feed on the trees at the Wiles Farm. More palatable grasses, mast, and crops were available during almost the entire winter, which was very unusual for Upstate New York.

Farther south from Lake Ontario at a higher elevation, there was more persistent snowfall at the Fetzer Farm in Allegany County (Figure 2). Based counts of missing branch tips, none of the study fir trees treated with repellents experienced detectable deer browsing. However, the control (untreated) fir trees had an average of 9.5 twig tips missing per tree. Therefore, Christmas trees treated with both the Trico® and Plantskydd® deer repellents experienced significantly less deer damage than control trees during winter 2019-20 on the Fetzer Farm.

With cold temperatures and persistent snow during winter 2020-21, the Sweeting Farm experienced heavy deer damage on fir trees (Figures 1 and 3). The number of limbs browsed by deer was significantly lower for fir trees treated with Trico® repellent than those treated with Plantskydd® or untreated control trees. Firs treated with deer repellents also experienced significantly less deer damage based on visual scores (Figure 4). Damage scores were significantly lower for trees treated with Trico® than those treated with Plantskydd® or control firs. More than 75% (n = 30) of the firs treated with Trico® repellent had no deer damage. Conversely, 0% (n = 30) of the untreated firs had a damage score of "3" or less (41-60% of limbs browsed). Also, Plantskydd® repellent failed to protect the firs from deer browsing, as all firs had some damage, and <10% (n = 30) of the treated trees had 1-20% of limbs browsed. The new Trico® deer repellent, containing sheep fat as the active ingredient, protected Fraser fir trees for at least 22 weeks (6 November 2020 to 14 April 2021) in New York State during winter when deer were food-stressed by snow and cold temperatures.

Discussion

Long-lasting repellent products are critically needed to protect Christmas trees from deer browsing, especially during winter when snow limits the accessibility to alternative forage. In past winter field trials, deer avoided repellents containing putrescent egg solids for up to 6 weeks, and other repellents tested failed after 4 to 5 weeks (Curtis and Boulanger 2010). Trico® deer repellent has a distinct advantage over other commercial products by providing longer duration protection. A single treatment of Trico® repellent

applied in late fall or early winter could protect trees until spring green-up in April when deer reduce feeding on woody landscape plants. An effective and long-lasting repellent like this could offer a practical alternative to expensive deer fencing needed to protect crops (Curtis et al. 1994). Also, deer repellents cannot be applied when there are freezing temperatures, or if plants are covered by snow or ice. These limitations have made most repellent applications impractical during winter months in the northern United States and Canada.

Ease of use is an important factor when selecting deer repellents. The pre-mixed Trico® repellent was simple to use and we had no problems spraying this repellent on the Christmas trees. We found the Plantskydd® powder concentrate difficult to mix and spray. The powder concentrate must be mixed slowly with water to prevent foaming, then it is then filtered to prevent clumping and clogging the sprayer nozzle. This would likely be a deterrent for use by most farm owners. Big Game Repellent® powdered concentrate containing putrescent egg solids was also difficult to apply in past deer repellent studies (Curtis and Boulanger 2010).

Environmental factors influence the relative effectiveness of deer repellents. Variables such as deer density, snow depth and duration, alternative forage available, plant palatability, and deer body condition (e.g., fat reserves) make it difficult to predict deer browsing pressure at a given site. In theory, repellents work by reducing the palatability of treated plants relative to other available forage (El Hani and Conover 1995, Curtis and Boulanger 2010). It is much more difficult to protect highly preferred trees such as Fraser firs, especially when persistent snow cover reduces the alternative forage plants available.

Summary

We observed deer damage to Fraser firs at two study sites, the Fetzer Farm in winter 2019-20, and the Sweeting Farm during winter 2020-21. The number of limbs browsed by deer were significantly lower for trees treated with Trico® repellent than those treated with Plantskydd® or untreated control firs. Christmas trees treated with repellents also experienced significantly less deer damage based on visual scores. More than 75% (n = 30) of the firs treated

with Trico® repellent had no deer damage. Conversely, all the untreated firs in our study had some deer damage, and 0% (n = 30) had less than 41-60% of limbs browsed. Although they experienced less damage than the untreated trees, the trees treated with Plantskydd® repellent all had some damage, and <10% (n = 30) of the treated trees had 1-20% of limbs browsed. Trico® deer repellent protected Fraser fir trees for at least 22 weeks (6 November 2020 to 14 April 2021) in New York State during winter when deer were food-stressed by snow and cold temperatures. It is possible to protect Christmas trees for the entire winter season with a single spray application of Trico® during November or early December.

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